Nelson Forest Region	Geographic Distribution of *Armillaria* Species	
	Research Summary 015	

INTRODUCTION

Armillaria root disease is attributed to a group of fungi that occurs worldwide in boreal, temperate and tropical forests. The fungi affect a broad variety of tree species (4). These fungi were previously thought to be one species, known as *Armillaria mellea*, however, research has shown that there are actually a number of species within the *Armillaria* group. This helps to explain the variation in disease characteristics found worldwide. Each species is now known by its specific species name (e.g. *A. ostoyae, A. sinapina*). There is one *Armillaria* species that retained the name *A. mellea*. This species is not found in B.C.

GLOBAL DISTRIBUTION OF ARMILLARIA SPECIES

Globally, there are approximately 36 known species of *Armillaria* (4). These species vary widely in characteristics. In Europe, species occurrence and geographic distribution has been well documented (4). Five of the European species are identical to, or closely related to, certain North American species (1). *Armillaria* species have been recognized as a component of the mycoflora of indigenous forests in New Zealand since 1879 (3). Seven species of *Armillaria* occur in Australia, mostly in the temperate areas. In one Australian study, *Armillaria* was found to occur on nearly all stumps after clearcutting of a first rotation radiata pine plantation (2). Some studies have been conducted on *Armillaria* root diseases in Japan, Korea, Africa and Siberia. There is still little information about the occurrence and effects of the fungi in South America and China.

DISTRIBUTION OF ARMILLARIA SPECIES IN NORTH AMERICA

Nine species of *Armillaria* have been identified and described in North America. The species and their effects on trees differ between deciduous and coniferous forests (8). The various *Armillaria* species found in deciduous forests act primarily as secondary pathogens of stressed trees. *Armillaria ostoyae*, the predominant *Armillaria* species in coniferous forests, is pathogenic with the degree of pathogenicity being determined by the inoculum potential of the fungus. Inoculum potential is the energy available to the fungus for infecting new hosts. When inoculum potential is low, the amount of damage, and the rate of spread, is also low. Conversely, when inoculum potential is high, the fungus acts as an aggressive primary pathogen capable of colonizing and killing living trees.

DISTRIBUTION OF ARMILLARIA SPECIES IN BRITISH COLUMBIA

There are six *Armillaria* species found in B.C., but most of these have only a limited occurrence and are not a concern to forest managers.

Armillaria ostoyae is the predominant root pathogen of conifers in the southern

half of the province. Susceptible host species also include deciduous trees, certain shrubs, and possibly some herbaceous plant species.

The behaviour of *A. ostoyae* varies considerably between coastal and interior areas of B.C. The effects of *A. ostoyae* are much more severe in the southern interior of B.C. than in coastal areas. On the coast, mortality due to *A. ostoyae* occurs primarily in young forests (both plantations and natural regeneration). In the southern interior, the pathogen can kill trees throughout the rotation (6). Reasons for this variation may be related to the greater ability of coastal trees to callus root lesions and therefore limit the spread of the fungus (Morrison, pers. comm.). Site productivity and tree growth may also play a role.

Another commonly occurring species, *Armillaria sinapina*, is found throughout most of B.C., primarily on aspen and other hardwoods. *A. sinapina* is only weakly pathogenic and is believed to exist mainly as a saprophyte (8). There is some question as to whether or not the fungus is pathogenic in younger trees. Studies in Alberta have shown that *A. sinapina* may be pathogenic in younger trees (5), however, there is no evidence to suggest that this is the case in B.C. (D. Morrison, pers. comm.).

Armillaria gallica (previously named *A. bulbosa*) and *Armillaria nabsnona* are found on hardwoods on the lower mainland and southern Vancouver Island (6). Neither species is of significant concern to forest managers. Occurrences of *Armillaria cepistipes* have also been recorded in B.C.. While the range of this species appears to be very broad (i.e. found in Stewart and Hope B.C.), its occurrence is rare and it is currently not a concern for forest managers. One other member of the *Armillaria* group has been found in B.C. but the species has not yet been identified. It is currently referred to only as NABS X. NABS X has been found on both coniferous and deciduous trees. Its extent appears to be limited to a very small area near Nelson, B.C. and a site near Fernie, B.C., hence it is not of significant concern to forest managers.

To date, only the two species of *Armillaria: A. ostoyae* and *A. sinapina* have been found to occur on a widespread basis in B.C., and are a concern to forest managers. *A. ostoyae*, which attacks all coniferous species, is the most pathogenic, and therefore the most damaging.

IMPLICATIONS OF ARMILLARIA OSTOYAE

Armillaria ostoyae may lower timber productivity by reducing tree growth, causing direct mortality of host trees, or predisposing trees to attack by insects or pathogens (9). The extent to which forests are vulnerable to the fungus varies considerably from ecosystem to ecosystem (4), site to site, and tree to tree. The Interior Cedar Hemlock zone (ICH) is one of the most productive and diverse biogeoclimatic zones in the province yet it is heavily impacted by *Armillaria* infection (9). The role of *Armillaria* root disease in shaping and/or maintaining the characteristics of these forests is poorly understood. Much more research is necessary before we fully understand *Armillaria* root disease, and the effect of forest management activities on its dynamics.

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Figure 1. Distribution of *Armillaria ostoyae* in British Columbia